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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/757,260	01/14/2004	Andrei Vityaev	15354US01	4382

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EXAMINER	
BAKER, STEPHEN M	
ART UNIT	**PAPER NUMBER**
2133	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	01/03/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	10/757,260	VITYAEV, ANDREI	
	Examiner	Art Unit	
	Stephen M. Baker	2133	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *17 October 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-27,30 and 31* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *11-25* is/are allowed.

6)☒ Claim(s) *1-10,26,27,30 and 31* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Specification

1. The disclosure is objected to because of the following informalities:

In the error correction coding art it is conventional to designate the number of random symbol errors correctable by an (***n***, ***k***) Reed-Solomon code as ***t*** wherein the Reed-Solomon code adds (***n*** - ***k***) = ***r*** = 2***t*** redundant symbols to ***k*** data symbols. The conventional Reed-Solomon code has a generator polynomial with 2***t*** consecutive roots and a degree of 2***t***. Applicant's parameters "t" and "k" do not correspond to ***t*** and ***k*** in the standard variable notation described above and thus applicant's choice of variable names is confusing.

Applicant's disclosure does not relate applicant's parameters "t" and "k" to any code generator polynomial design objective, other than doing so indirectly through the sum "(2t + 2k)" is equal to the number of redundant symbols, normally represented as (***n*** - ***k***) = ***r*** = 2***t*** redundant symbols. Accordingly, applicant's parameters "t" and "k" are seen as being entirely arbitrary. Furthermore, applicant's parameters "t" and "k" are described as inevitably being equal to each other (at least according to the equation for the first polynomial in paragraph 0016, where "t" is replaced by "k"), and are only used after a multiplication by two which factor also lacks any described relation to any code generator polynomial design objective.

It's furthermore noted that it's well known in the Reed-Solomon coding art that adding one redundancy symbol (*i.e.* adding one more consecutive root to the generator

polynomial) adds the ability to locate one more symbol in error (which is erasure location and a form of error detection) and that adding a second redundancy symbol adds the ability to correct a located error (which is erasure correction), and correspondingly it's well known that adding two redundancy symbols adds the ability to correct one more unknown error symbol. In other words, it's well known that ***r*** redundancy symbols can correct ***t*** errors and ***e*** erasures, for any values of ***t*** and ***e*** chosen such that $r = (2t + e)$ and, equivalently, it's well known that ***r*** redundancy symbols can correct ***t*** errors and detect ***d*** errors, for ***t*** and ***e*** chosen such that $r = (2t + d)$. In other words, it is not the number of roots (r –x + x) in applicant's first and second polynomials that respectively defines the error correction and error detection capacities of the product generator polynomial, but it is the number of roots ***r*** in the product polynomial that determines these capacities conventionally, according to $r = (2t + d)$. Accordingly, applicant's generator polynomial selection process appears to be an artificial and arbitrary breaking up of the conventional process of selecting $r = (2t + d)$ or $2t$ (in the case of error-correction-only decoding) consecutive roots into a two-part process of selecting two consecutively-positioned consecutive sets roots to arrive at $r = (2t + d)$ or $r = 2t$

Appropriate correction is required.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 1, 2, 4, 5, 7 and 10 are rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 5,872,799 to Lee *et al* (hereafter "Lee").

Regarding claims 1, 2, 4 and 10, Lee shows (column 8, lines 40-41) an equation for factors of a code generator polynomial expressed as: $G_1(x) = (x^3+\alpha^0)(x^3+\alpha^1)(x^3+\alpha^2)$ and $G_2(X) = (x+\alpha)$, the first factor containing three consecutive roots and the second factor containing one (consecutive) root.

Regarding claim 5, the codewords of Lee's code are written to a disk drive, one codeword per sector.

Regarding claim 7, generating a Reed-Solomon codeword requires dividing an information polynomial ("third polynomial") by the generator polynomial ("said product") and using the remainder as the code's redundancy symbols.

4. Claims 1, 2 and 4 are rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 5,465,260 to Zook (hereafter "Zook").

Zook describes (column 4, lines 47+) a Reed-Solomon code generator polynomial with ***v*** consecutive powers as roots α^{r-v+1} to α^r and a CRC code generator polynomial with ***k*** consecutive powers as roots α^{r+1} to α^{r+k}. The combined Reed-Solomon/CRC code is the product of both code generator polynomials.

5. Claims 26, 27, 30 and 31 are rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 6,363,511 to Massoudi *et al* (hereafter "Massoudi").

Massoudi discloses a decoder (Fig. 4B) for Reed-Solomon product-code codewords, including two stages of correction (410, 414). Massoudi also mentions the possibility of a software-based implementation (column 13). Massoudi's row correction stage (410) provides a "first processing stage used to correct a first maximum number of symbol errors in said encoded codeword," Massoudi's column and EDC syndrome generator stage (412) provides a "second processing stage used to detect symbol errors" and Massoudi's column correction stage (414) provides a "third processing stage used to correct a second maximum number of symbol errors in said encoded codeword."

Massoudi's row correction uses 10 redundant symbols per row and Massoudi's column correction uses 16 redundant symbols, capable of correcting more errors (8 errors correctable per column correction vs. 5 errors correctable per row correction, using the DVD standard product code. Consequently, Massoudi's first error correction stage corrects up a first number (5) of errors, while Massoudi's second error correction stage corrects up a sum of a first number (5) and a second number (3) of errors for a total of 8 errors correctable in Massoudi's second stage. It should go without saying that both the first and second numbers (5 and 3) can be said to respectively correspond to half the degrees of any polynomials of degree 10 and 6, consecutive roots or not.

6. Claims 1, 2, 4, 5, 7 and 10 are rejected under 35 U.S.C. 102(e) as being anticipated by U.S. Patent No. 6,978,415 to Weng (hereafter "Weng '415").

Weng '415 discloses (column 4, lines 32-40) selecting a generator polynomial $g(x)$ for a Reed-Solomon code as a product of a first polynomial and a second polynomial, $g(x) = g_1(x) \cdot g_2(x)$. The recited purposes for selecting the first and second polynomials is given no patentable weight, it being understood that well-known capabilities for error correction and for error detection are inherent in both $g_1(x)$ and in $g_2(x)$

Regarding claims 5 and 10, the codewords of Weng '415's Reed-Solomon code are for writing to a magnetic disk drive.

Regarding claim 7, generating a Reed-Solomon codeword inherently requires dividing an information polynomial ("third polynomial") by the generator polynomial ("said product") and using the remainder as the code's redundancy symbols.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. Claims 8 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Weng '415 in view of U.S. Patent No. 5,948,117 to Weng *et al* (hereafter "Weng '117"), or in view of U.S. Patent No. 5,778,009 to Fredrickson *et al* (hereafter "Fredrickson").

Weng '417 does not mention Reed-Solomon codes with 10-bit symbols (Reed-Solomon codes defined over GF(2^{10}). Official Notice is taken that the usefulness of

using a Reed-Solomon code defined over GF(2^{10}) for encoding data to be stored in magnetic disk drives was well-known at the time the invention was made, as evidenced by Fredrickson and Weng '117. Fredrickson's code generator polynomial has symbols in GF(2^{10}) meaning the symbols are 10-bit symbols, the maximum code length is (2^{10}-1) = 1023 symbols, so a single codeword can fill an entire sector.

It would have been obvious to a person having ordinary skill in the art at the time the invention was made to implement the generator polynomial selection process disclosed by Weng '415 by using polynomials defined over GF(2^{10}). Such an implementation would have been obvious because that the usefulness of using a Reed-Solomon code defined over GF(2^{10}) for encoding data to be stored in magnetic disk drives was already well-known.

9. Claims 3 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zook.

Regarding claim 3, Zook does not specify $v = 48$. Official Notice is taken that it's well known that a Reed-Solomon code can be designed to correct t errors for values of t including $2t = 48$. It would have been obvious to a person having ordinary skill in the art at the time the invention was made to implement Zook's arrangements with a value of $v = 48$. Such an implementation would have been obvious because it was already well known that a Reed-Solomon code can be designed to correct t errors for values of t including $2t = 48$.

Regarding claim 6, Zook does not specify a CRC with four check symbols, i.e. $k = 4$. Official Notice is taken that CRCs with four check symbols, *i.e.* with 32 bits in the

case of codes defined over GF(2^8), were conventional at the time the invention was made. It would have been obvious to a person having ordinary skill in the art at the time the invention was made to implement Zook's arrangements with a value of $k = 4$. Such an implementation would have been obvious because CRCs with four check symbols, were already conventional.

Allowable Subject Matter

10. Claims 11-25 are allowed.

Response to Arguments

11. Applicant's arguments filed 17 October 2006 have been fully considered but they are not persuasive.

Applicant's arguments against the prior art have been addressed in the rejections as now elaborated.

Conclusion

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Stephen M. Baker whose telephone number is (571) 272-3814. The examiner can normally be reached on Monday-Friday (11:00 AM - 7:30 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Albert DeCady can be reached on (571) 272-3819. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Stephen M. Baker
Primary Examiner
Art Unit 2133

smb